

**L3(5.3) - Transformations & Graphing from Vertex Form**

vertex form:

$$y = \pm a(x - h)^2 + k$$

+, parabola opens up  
-, parabola opens down

- if  $a > 1$ , vertical stretch
- if  $0 < a < 1$ , vertical compression

•  $h$  is the  $x$ -coordinate of the vertex  
• will result in a horizontal shift (left or right).

•  $k$  is the  $y$ -coordinate of the vertex  
• will result in a vertical shift (up or down)

To graph, choose a strategy:

1. Table of Values
  - starting method for any graph
  - try to choose  $x$ -values around axis of symmetry
  - calculate  $y$ -values and plot points
2. Transformations
  - determine transformations in correct order
  - apply transformations to key points from  $y = x^2$
3. Vertex & Step Pattern
  - determine location of vertex
  - determine step pattern compared to  $y = x^2$
  - note direction of opening (vertical reflection?)
  - build parabola starting at vertex

Ex.1 Graph  $y = 2(x - 3)^2 - 4$  by transforming points from  $y = x^2$ .

Vertex  $(3, -4)$

Step pattern 2, 6, 10

$y = x^2$

x	y
-2	4
-1	1
0	0
1	1
2	4

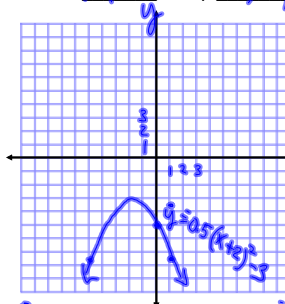
- 1) V. Stretch by a factor of 2 -- effects (y)
- 2) H. Shift right by 3 ----- effects (x)
- 3) V. Shift down by 4 ----- effects (y)

$(-2, 4) \xrightarrow{y \times 2} (-2, 8) \xrightarrow{x + 3} (1, 8) \xrightarrow{y - 4} (1, 4)$   
 $(-1, 1) \rightarrow (-1, 2) \rightarrow (2, 2) \rightarrow (2, -2)$   
 $(0, 0) \rightarrow (0, 0) \rightarrow (3, 0) \rightarrow (3, -4)$   
 $(1, 1) \rightarrow (1, 2) \rightarrow (4, 2) \rightarrow (4, -2)$   
 $(2, 4) \rightarrow (2, 8) \rightarrow (5, 8) \rightarrow (5, 4)$

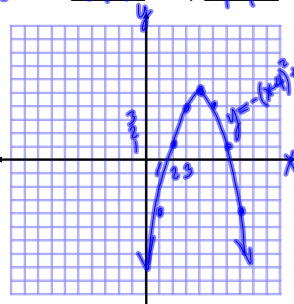
Ex.2 Graph  $y = -0.5(x + 2)^2 - 3$  using the vertex and step pattern.

State the vertex and the step pattern, then graph.

$$(a) y = -(x - 4)^2 + 5$$

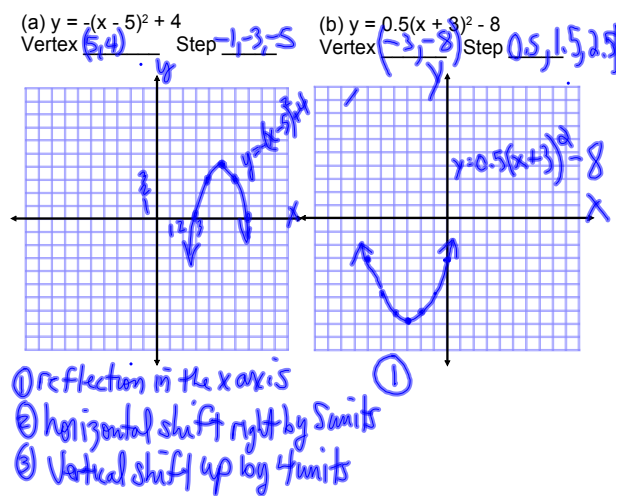
Vertex  $(-2, -3)$ Step  $-0.5, -1.5, -2.5$ Vertex  $(4, 5)$ Step  $-1, -3, -5$ 

- ① reflection in the x axis
- ② vertical compression by a factor of 0.5
- ③ Horizontal shift left by 2 units
- ④ Vertical shift down by 3 units

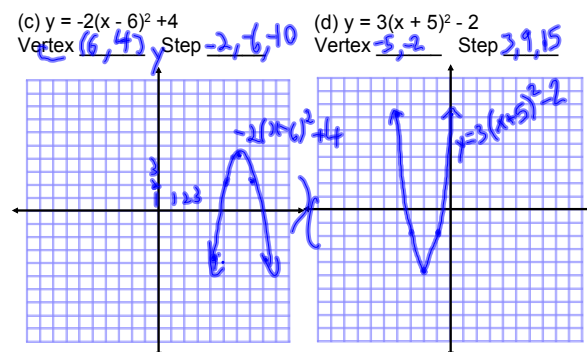


- ① reflection in the x axis
- ② horizontal shift right by 4 units
- ③ vertical shift up by 5 units

State the vertex and the step pattern, then graph.



State the vertex and the step pattern, then graph.



Assigned Work: p.269 #1 - 3 (basics),

4odd, 5odd, 6, 7odd, 11, 13, 14, 15, \*10